Bus Embarking System for Visual Impaired People using Radio-Frequency Identification

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***Abstract*:**

Engineers have a social responsibility towards the improvement and the development of the infrastructure and design in the field of integrated engineering. Designing and developing a human assistance system for the blind people integrates technology into devices using which culminates the magic of conventional system. Bus journey has to be safe and comfort since navigation in outdoor environment is highly difficult for people having congenital blindness or blind people. Several solutions have been proposed like walking stick or white cane, guide dogs and GPS guidelines to deal with this difficulty. Although different techniques have been useful in several real-time scenarios, an improvement in deploying the use of artifacts is not natural for blind users. The paper aims to develop a bus detection hardware prototype using Radio Frequency Identification (RFID) for vision blindness. RFID has the potential to be a useful aid with the standardization of RFID tags and RFID readers. The system contains RFID communication technology to communicate visually impaired with the outdoor environment those who travels by bus. It is a convenient system that the person freely uses the transport system without any assistance using the integrated engineering technology.

Keywords: *Visually Impaired People, Navigation System, Ultrasonic Sensor, PIC16F877A, RFID, Speech Recognition, Voice Circuit.*

I. INTRODUCTION

Radio Frequency Identification (RFID) is the emerging technology in recent year and has lot of potential abilities in compensating the societal and the economic needs of the society. In most of the application, RFID technology is used for the implementation & design of modules for different control & human assistance system [1]. The purpose of the system is to develop & design a bus embarking system which provides a human assistance for the navigation of the visually impaired people. For visually impaired people, an outdoor pedestrian mobility is very complicated and dangerous. Visually impaired commonly rely on a white cane or walking stick and a guide-dog to assist them without harm to reach an accurate path [5. However, the guidance system is useful only when the path is already known to the blind people. Buses are an important medium for traveling from ancient times. Majority of blind and visually impaired people travel in the public transport and it is a feasible transport option to seek social connectivity. The people who lives in a particular environment is difficult to sense what happen around us and these activities will be reduced in several fields [3]. Normally, the blind people need in assistance, while travelling in a bus. The proposed system uses RFID technology to provide human assistance to help the blind people while traveling by bus feel more comfortable and enjoy like an ordinary people without any assistance during transportation. For this purpose, a bus detection system using RFID technology is more suitable for the mobility of blind people [3]. The proposed system consists of two system tags, one on the bus act as a transmitter (RFID TAG) and other with the blind people as a wearable [4 & 6] device which acts as a receiver (RFID READER). The RFID TAG can send the details about the bus route, bus name, timing, distance and also existing bus information to the blind people by using RFID READER. RFID reader receives the detail about the bus information and announce through voice module to the blind people [9]. A complete system is constructed and tested to valid a proposed system. The system results show that its performance is effectively safe and reduces the manufacturing cost to a lower extent.

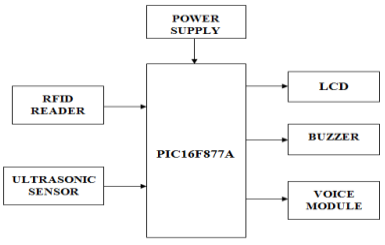

Fig 1: Bus Embarking System using RFID

II. DESIGN METHODOLOGY

The execution of the design module can be devised as follows: 1. Destination voice to the blind 2. Tag identification to reach the destination 3. Ultrasonic sensor detection 4. Buzzer ring and voice module.

A. Destination Voice to the Blind

Microcontrollers offer different kinds of memories such as EEPROM, EPROM, FLASH , etc . Among these, FLASH is the most recently emerging technology used in PIC 16F877A microcontroller which retains the data even when the power is switched off [10]. Easy Programming and Erasing are also the other features of PIC 16F877A. PIC 16F877A CMOS Flash unit contains 8 bit microcontroller and the 200 instruction executed in nano seconds per cycle. PIC 16F877A has high performance RISC CPU and its operating voltage range is 2 to 5.5V where the temperature ranges from -40 to +125. PIC16F877A has highly flexible low cost microcontroller design tool and low power consumption. The proposed system uses PIC 16F877A microcontroller which can hear all the sounds in the maximum frequency range of 20MHZ to effectively sense the word by the blind people.

B. Tag Identification to the Blind

Radio-frequency identification (RFID) uses electromagnetic field to automatically identify and track tags attached to objects. The tags contain electronically stored information. Passive tags collect energy from a nearby RFID reader's interrogating radio waves. Active tags have a local power source such as a battery and may operate at hundreds of meters from the RFID reader. Unlike a barcode, the tag need not be within the line of sight of the reader, so it may be embedded in the tracked object. RFID is a method for Automatic identification and data capture (AIDC). RFID systems consist of three components are RFID tag, reader, and an antenna.

C. RFID Tag

RFID tags can be used either passive or active tag. An active tag has an on-board battery and periodically transmits its ID signal to activate in the presence of RFID reader. A passive tag is cheaper and smaller because it has no battery and the tag uses the radio energy transmitted by the reader. Field programmable tags may be write-once, read-multiple; "blank" tags may be written with an electronic product code by the user. RFID tags contain at least two parts: an integrated circuit for storing and processing information, modulating and demodulating a radio frequency (RF) signal, collecting DC power from the incident reader signal and the tag information is stored in a non-volatile memory. The RFID tag includes either fixed or programmable logic for processing the transmission and sensor data, respectively. An RFID reader transmits an encoded radio signal to interrogate the tag. The RFID tag receives the message and then responds with its identification and other information. This may contain a unique tag serial number.

D. RFID Reader

The radio frequencies are used to decode the data in the RFID tag and are produced by the RFID reader. When a radiofrequency wave interacts with an RFID tag, the pins or the bar code energizes and produces its own magnetic field which has a unique interference pattern and the information read by the RFID reader and it would obtain the unique number designated to the corresponding RFID tag. Thus the RFID reader obtains the address of the desired RFID tag to identified the tag and get the information [1]. The below diagram represents the Communication the tag and the transponder.

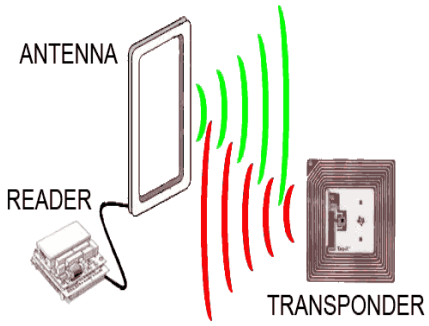

Fig 2: RFID Communication

III. ULTRASONIC SENSOR DETECTION

Ultrasonic sensors emit short, high-frequency sound pulses at regular intervals. These propagate in the air at the velocity of sound. If they strike an object, then they are reflected back as echo signals to the sensor. Ultrasonic waves are sounds which cannot be heard by humans in the normal condition, with frequencies of above 20 kHz. In order to detect the presence of an object, ultrasonic waves are reflected on objects. It is used to detect the obstacles in front of the blind to navigate [2]. The given below diagram represents the HC-SR04 sensor.

Fig 4:HC-SR04 Sensor

IV. BUZZER RING AND VOICE MODULE

A buzzer is an audio signaling device which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input.

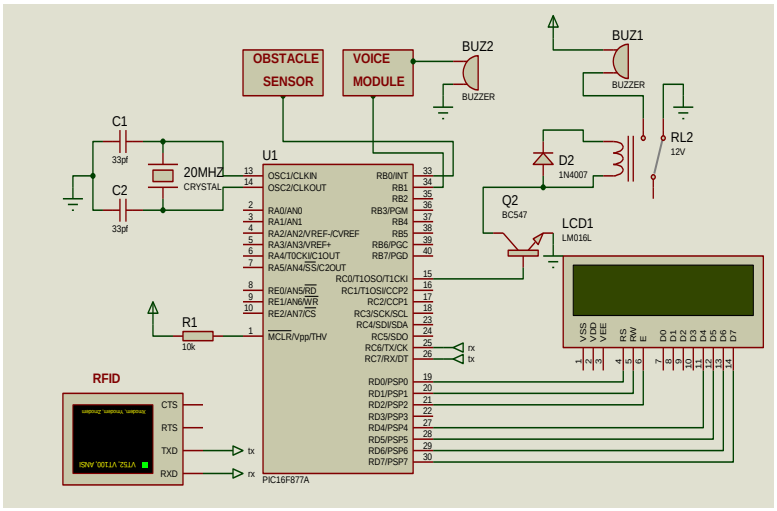

Fig 5: Working Principle of Visually Challenged Unit

Fig 6: Hardware-Blind unit

Fig 7: Hardware-RFID Tag

Fig 7: Hardware-RFID Reader Tag

A Piezo electric buzzer can be driven by an oscillating electronic circuit or other audio signal source. A click, beep or ring can indicate that a button has been pressed. The given below diagram represents the buzzer.

Fig 4: Buzzer

V. BUS EMBARKING HARDWARE PROTOTYPE USING RFID

The proposed model consists of two parts. The first part consists of RFID tag which is placed into the bus in which the information are fed into the tag and each bus having own tag. Through the electromagnetic field emitted by the RFID tag, the information about the bus is sent to the RFID reader. Whenever the signal enter the RFID receiver it will get the energy from the transmitter and then sends the details about the outdoor environmental conditions to it. The second one is receiver system. Visually challenged has this receiver unit which is used to read the information's from the bus then convert into voice which can be heard through the voice board module. Also the obstacle sensor is used to sense the objects in between the path [8]. Any obstacle in the path will be sensed and sound gets produced through buzzer which makes the visually challenged to be safe to clearly identify the path to reach the destination. The diagram represents the working principle about the connection with the blind unit. The diagram also represents the steps involved in RFID technology to navigate the blind people without any assistance [9].

1. The RFID Tag and RFID Reader act as transmitter and receiver respectively.
2. The antenna sending high frequency of electromagnetic waves.
3. The RFID Reader converted the waves into speech through voice module.
4. The obstacle sensor is used to sense the object.
5. Buzzer is to indicate the blind people to reach the destination safe and clearly without any assistance.

A. Implementation

Integrated Engineering has been under its progress marching towards the solution oriented hardware prototype which paved a wide way to develop the artifacts based upon the requirements and needs of the society. The hardware requirement for the simulation consists of PIC Micro-Controller**,** RFID Reader**,** RFID TAG, Object Sensors, Buzzer, and LCD & GSM. The softwares are used to interact with the hardware interface where the programming can be done by using Embedded C, PCW IDE Compiler.

To navigate the blind people without any assistance has been successfully implemented by using RFID technology. The results has distributed into three units such as

1) i) Hardware-Blind unit ii) Hardware-RFID Tag unit iii) Hardware-RFID Reader unit iv) Hardware-Blind unit:

2) The Fig 6 shows the hardware blind unit. The hardware unit consist of the RFID Reader , RFID Tag, ultrasonic sensor, buzzer, voice module are used to navigate the blind people without any assistance.

3) The Fig 7 shows the hardware-RFID Tag unit. RFID Tag is used to store the information of the bus by the program.

4) The Fig 8 shows the hardware-RFID Reader unit. The RFID Reader receives the bus details from RFID Tag and converted through speech by using voice modules then he/she starts to move.

VI. CONCLUSION

Blind and visually impaired people need some aid to interact with their environment which enhances their security during mobility [11]. Bus Embarking system using RFID technology makes secure communication for the visually challenged. The purpose is to have an interactive blind aid system for the visually impaired so they can travel like a normal people in buses comfortably like others. Use of ultra-high frequency radio waves, shown in the system uses RFID tag and reader setup along with customized program that will help the blind people to identify the exact bus. Results of the test indicates that the system could help to user successfully reach the desired buses, using the interactive communication modules.

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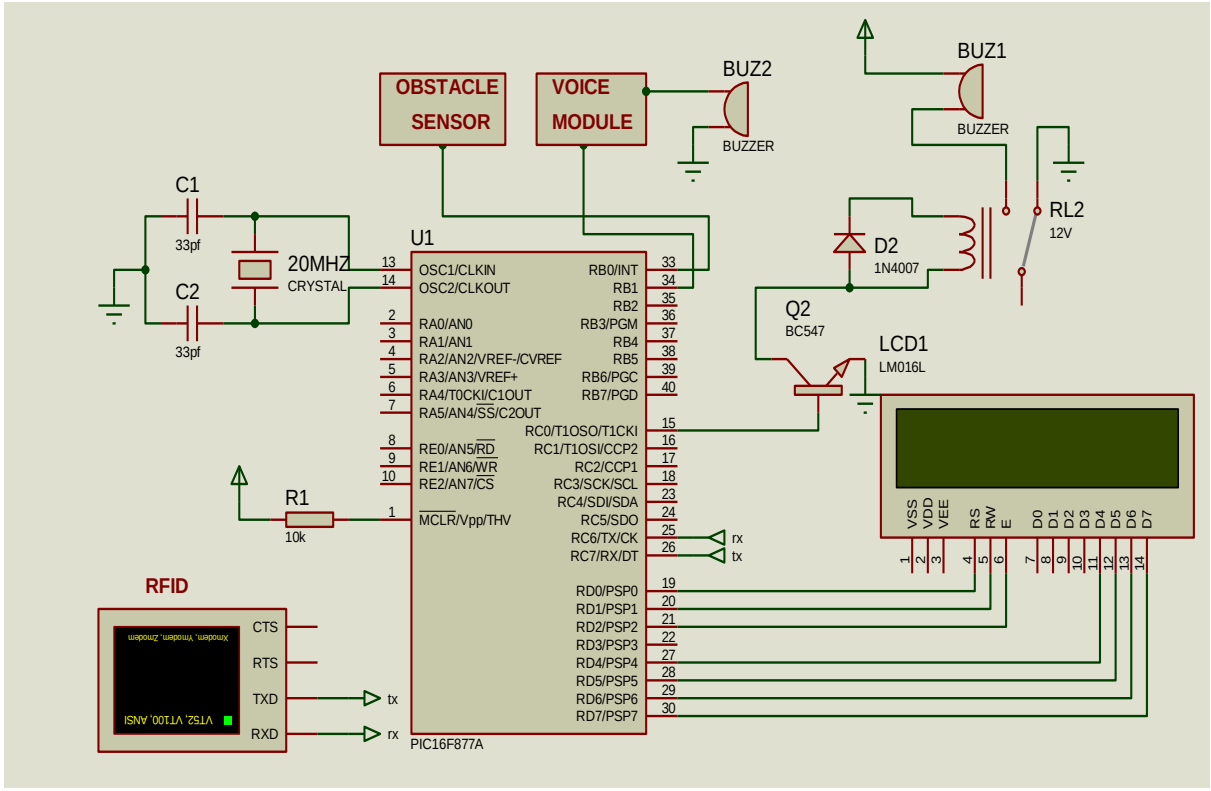
OBSTACLE SENSOR
VOICE MODULE
BUZ2
BUZZER
BUZ1
BUZZER
RL2
12V
D2
1N4007
Q2
BC547
LCD1
LM016L
C1
33pf
C2
33pf
20MHZ
CRYSTAL
U1
OSC1/CLKIN
OSC2/CLKOUT
RA0/AN0
RA1/AN1
RA2/AN2/VREF-/CVREF
RA3/AN3/VREF+
RA4/T0CKI/C1OUT
RA5/AN4/SS/C2OUT
RE0/AN5/RD
RE1/AN6/WR
RE2/AN7/CS
MCLR/Vpp/THV
RB0/INT
RB1
RB2
RB3/PGM
RB4
RB5
RB6/PGC
RB7/PGD
RC0/T1OSO/T1CKI
RC1/T1OSI/CCP2
RC2/CCP1
RC3/SCK/SCL
RC4/SDI/SDA
RC5/SDO
RC6/TX/CK
RC7/RX/DT
RD0/PSP0
RD1/PSP1
RD2/PSP2
RD3/PSP3
RD4/PSP4
RD5/PSP5
RD6/PSP6
RD7/PSP7
PIC16F877A
R1
10k
RFID
CTS
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